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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
ROSENBERGER, FREDERICK F	
ART UNIT	**PAPER NUMBER**
2878	

DATE MAILED: 04/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/654,780	OPFERMANN ET AL.	
	Examiner	Art Unit	
	Frederick F. Rosenberger	2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. Applicant is advised that no Information Disclosure Sheet was received with this application.

Oath/Declaration

2. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because:

It does not identify the mailing address of each inventor. A mailing address is an address at which an inventor customarily receives his or her mail and may be either a home or business address. The mailing address should include the ZIP Code designation. The mailing address may be provided in an application data sheet or a supplemental oath or declaration. See 37 CFR 1.63(c) and 37 CFR 1.76.

It does not identify the citizenship of each inventor.

It does not identify the city and either state or foreign country of residence of each inventor. The residence information may be provided on either on an application data sheet or supplemental oath or declaration.

Specification

3. The abstract of the disclosure is objected to because paragraph 4 (lines 18-21) is a substantial repetition of paragraph 3 (lines 13-16). Correction is required. See MPEP § 608.01(b).

4. The disclosure is objected to as failing to comply with 37 CFR 1.52(b)(5). Specifically, applicant fails to number the first page of the disclosure (page entitled "New US Patent Application"), which includes the title of the present application. Where necessary for citation for this Office action, applicant's page numbers have been used. Appropriate correction is required.

5. The disclosure is objected to because of the following informalities:

Page 2, line 1: "the shape of the laser pulses it left out of..." should be "the shape of the laser pulses is left out of..."

Page 3, line 1: "particularly the range..." should be "particularly to the range..."

Page 4, line 20: "With such an inventive correction is has now..." should be "With such an inventive correction, it has now..."

Page 10, line 17-18: "the transparency of the sample With additional..." should be "the transparency of the sample. With additional..."

Page 13, line 30: "This pulse can by expediently..." should be "This pulse can be expediently..."

Figure 5 has not been described or discussed in the disclosure. Only Figures 1-4 have been addressed on pages 12-14 of the disclosure.

Appropriate correction is required.

Claim Objections

6. Claims 1-12 are objected to because of the following informalities:

Claim 1: Applicant refers to "approximating a laser pulse" in line 19 although the specific nature of the source outside of being a source of radiation has not been described in the claim. Applicant also refers to "approximated optical pulse" in line 23-24. It is unclear if applicant intends the recitation of "laser pulse" and "optical pulse" to be further limiting as to the nature of the radiation source. For the purposes of this Office action, claim 1 has been interpreted such that the source of radiation is a laser capable of pulsed output to satisfy the above limitations.

Claims 2-6: The variables of the equation recited in the body of each claim have not been defined in the claim.

Claim 4: The recitation of $I_1(t)$ in the equation of claim 4 lacks antecedent basis as $I_1(t)$ has not been defined in the parent claim 1.

Claim 4: In lines 3-5 of the claim, applicant recites that the analyzer unit is designed for approximating a high speed rising edge of the laser pulse by a formula for $I_2(t)$. This recitation lacks antecedent basis in the specification as applicant states on page 7, lines 20-24, that the claimed equation for $I_2(t)$ is used in the approximation of the slightly downward sloping plateau of the laser pulse. For the purposes of this Office action, claim 4 has been interpreted such that the analyzer unit is designed for approximating the slightly downward sloping plateau of the laser pulse by the claimed formula for $I_2(t)$, in agreement with the specifications.

Claim 5: The recitation of $I_2(t)$ in the equation of claim 5 lacks antecedent basis as $I_2(t)$ has not been defined in the parent claim 1.

Claim 5 and page 8, line 12: In the equation of claim 5 and on page 8, line 12, applicant defines $I_3(t) = I_2(t=\text{Delay} + t_e) \bullet$ exponential. The expression for I_2 in the equation can be confusing. It is understood via the specifications that applicant intends to define the intensity as the approximated intensity for the plateau of the laser pulse at a time t = (Delay $+t_e$), i.e. the time where the laser would be shutoff. Thus it would be more appropriate to write the equation as:

$$I_3(t) = I_2(\text{Delay} + t_e) \bullet \exp\{-(t - \text{Delay} - t_e)/\tau_3\}.$$

Claim 6 and page 9, line 1: In the equation of claim 6 and on page 9, line 1, applicant defines $I_3(t) = I_2(t=\text{Delay} + t_e) \bullet$ exponential. The expression for I_2 in the equation can be confusing. It is understood via the specifications that applicant intends to define the intensity as the approximated intensity for the plateau of the laser pulse at a time t = (Delay $+t_e$), i.e. the time where the laser would be shutoff. Thus it would be more appropriate to write the equation as:

$$I_3(t) = I_2(\text{Delay} + t_e) \bullet \text{exponential}.$$

Appropriate correction is required.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claim 13 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not

described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Regarding claim 13, applicant recites that the analyzer unit is designed for performing convolution by way of subtraction of spectrally transformed measured values and subsequent re-transformation. On page 13, lines 1-6, applicant attempts to provide basis for claim 13. However, applicant is silent as to which values would be spectrally transformed (i.e. the measured values of the infrared sensor or the optical pulse), what is to be subtracted, and the methodology by which the convolution incorporates the results of the transformation. Applicant only mentions the particular transformation techniques that may be used.

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 11, the phrase "preferably" renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

For the purposes of this Office action, the limitation of double or triple layers has not been given patentable weight in the analysis of claim 11.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claims 1-7, 9, and 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knudsen et al. (US Patent # 4,928,254) in view of Blumm et al. (Journal article entitled "Improvement of the mathematical modeling of flash measurements").

Knudsen et al. disclose a laser flash thermal conductivity measurement apparatus and method comprising:

A source of radiation, in the form of an Yttrium Aluminum Garnet Laser **10** (Figure 1), for emitting high-energy pulsed radiation onto the sample **12** for heating the sample **12**;

An infrared sensor, in the form of InSb photovoltaic detector **20** (Figure 1 and column 4, lines 52-55), for detecting the time history of the infrared radiation emitted by the sample **12**;

A decoupler element (Figure 1, not labeled but located below photodiode **19** and between dichroic mirror **17** and the sample **12** along the incident beam path) for decoupling a reference radiation from a beam emitted by said source radiation;

A second sensor, in the form of photodiode **19** (Figure 1 and column 4, lines 17-19), for measuring said reference radiation;

And an analyzer unit, in the form of computers **26** and **28** (Figure 1), for detecting the thermal conductivity of the sample **12** by analyzing the signals of the infrared sensor.

Knudsen et al. are silent with regards to the bandwidth of the second sensor being equal to the reciprocal of the radiation pulse length. However, the bandwidth characteristics of a sensor is a direct measure of the response of the sensor to time varying radiation, i.e. a lower bandwidth would inhibit the ability of the second sensor to respond appropriately to changes in the laser pulse. Thus, choosing a minimum bandwidth equivalent to the frequency of the optical pulse would be obvious to a person having ordinary skill in the art at the time the invention was made in order to accurately measure the time profile of the incident laser pulse.

Knudsen et al. are further silent with regards to a furnace for heating the sample to a predetermined temperature.

Blumm et al. teach that by placing the sample in a tubular furnace the temperature of the sample can be maintained. Further, the use of the furnace provides for the ability to determine the thermal conductivity at various temperatures (page 515, paragraph under 1. Introduction).

Thus, it would have been obvious for a person having ordinary skill in the art to modify Knudsen et al. to include a furnace to provide the ability to determine thermal conductivity at various elevated temperatures, as taught by Blumm et al.

Knudsen et al. are further silent with regards to correction of the thermal conductivity measurement based on the infrared signal by convolution with an approximated laser pulse based on the measured data by the second sensor in a model function for heat transfer.

Blumm et al. teach the use of a Cape-Lehman approximation in a heat transfer function to determine a temperature function (equation 1 on page 516) indicative of the temperature distribution of the sample during the laser flash measurement. In that equation, $W(\tau)$ represents the laser pulse approximation as a correction to the model function. The laser pulse approximations $W(\tau)$ are defined by equation 16 on page 519, which are equivalent to the laser pulse approximations of claims 2, 4, and 5. Blumm et al. teach that these approximations allow an accurate pulse description compared with square/triangular functions and thus enable pulse correction of the thermal conductivity determination (page 519, second paragraph). Although the specific equations of claims

3 and 6 are not disclosed, it is obvious that they are mathematical manipulations of the equations of claims 2 and 5 given two different time constants for the respective edge of the laser pulse.

Thus it would have been obvious for a person having ordinary skill in the art to modify Knudsen et al. to include correction of the conductivity measurement based on the infrared data via convolution of an approximated laser pulse based on the second sensor measured data with a model heat function so as to obtain a more accurate measurement of the thermal conductivity of the sample, as taught by Blumm et al.

Although neither Knudsen et al. nor Blumm et al. address detection of the time difference between a rated zero point in time and a starting point of approximated laser pulse, such a determination would have been obvious to one skilled in the art in order to provide coherence in the analyzer between the correction based on the reference radiation (i.e. the approximated laser pulse) and the measured infrared signal.

Further, with regards to claims 11 and 12, since the combination of Knudsen et al. and Blumm et al., as discussed above, has all of the structural elements as described in claim 1, it would be capable of determining the thermal conductivity of a sample based on the measured infrared signal and the convolution of an optical pulse by means of a model function for heat transfer in multiple layers having thermal resistance.

13. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knudsen et al. and Blumm et al., as applied to claim 1 above, and further in view of Applicant's Own Admission of Prior Art (hereinafter referred to as APA).

The combination of Knudsen et al. and Blumm et al. disclose all of the limitations of parent claim 1, as described above. However, the combination of Knudsen et al. and Blumm et al. are silent with regards to the application of a Cowan approximation or translucent material appropriate approximation in the model function for heat transfer.

APA teaches that a Cowan approximation (page 9, lines 6-15) can be used as the approximation equation for heat transfer to obtain more accurate heat transfer results. Although not as accurate as the Cape-Lehmann solution because it does not account fully for heat loss, it does offer a simpler equation for easier and faster processing by the analyzer.

Thus, it would have been obvious for a person having ordinary skill in the art to modify the combination of Knudsen et al. and Blumm et al. to include a Cowan approximation to obtain more accurate thermal conductivity measurements of a sample based on a more accurate heat transfer model while minimizing processing time, as taught by APA.

Further, APA teaches that a heat transfer solution proposed by Mehling et al. can be used to determine the heat transfer of translucent materials (page 9, lines 21-26).

Thus, it would have been obvious to a person having ordinary skill in the art to modify the combination of Knudsen et al. and Blumm et al. to use a Mehling

approximation for the heat transfer equation so as to be able to determine the thermal conductivity of translucent samples, as taught by APA.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Cheindline et al. (US Patent # 6,273,603) disclose a measurement system for determining thermal diffusivity, and thus thermal conductivity, using a radiant source in a flash (i.e. pulsed) measurement system, which includes a furnace for maintaining the ambient temperature around the sample for accurate measurements.

Blumm et al. (Journal article entitled "Influence of test conditions on the accuracy of laser flash measurements") disclose use of the laser flash method with optical pulse correction in determination of thermal diffusivity of a sample.

Baba et al. (Journal article entitled "Improvement of the laser flash method to reduce uncertainty in thermal diffusivity measurements") details improvements to the laser flash method for determining thermal diffusivity, including more uniform heating, faster sensors, and new data analysis techniques using real boundary conditions.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frederick F. Rosenberger whose telephone number is 571-272-6107. The examiner can normally be reached on Monday-Friday 7:30 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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